

# Process Definition

Cory Leland

# Process Definition Team

- Ken Sheehan
- Dave Marlow
- Carol Malone
- Ray Admire
- Jess Crusey
- Larry Maggiano
- Rob Edgeworth
- Murray Desnoyer
- Al Wavering
- Tim Taylor
- Andy Smith
- John Wootton
- Cory Leland
- Kalyan Bhamidi
- Helen Guixiu Oiao
- Art Whistler
- Robert Callaghan
- Doug Sponseller
- Curtis Brown

Product Definition: includes geometry, features, tolerances, and manufacturing info.

**Knowledge**

Material

Sensors

ASME  
Machine  
Characterization

Constraints

Rules

Generate macro process plan

1. Machining plan/program
2. Equipment decision
3. Decide what measurements to make – measurands (measurement method) and purpose
4. Desired uncertainties
5. Outlier handling and filtering of inspection and analysis

Generate micro process plan

1. Part inspection program, motions, inspections, recording and reporting

CMM

Machine  
Tool

Vision

Hand Guages

...

Laser  
Trackers

DMIS or other microplanning language

Collect measurements on equipment (CMM, gages, etc.)

Measurement and quality data

Execute Inspection Process:

Dimensional  
data

Large data  
sets

Non-  
dimensional  
measurement  
data

Measurement  
history data  
(SPC)

Quality Data

Comment: Assume there is always software between the equipment and analysis/display software that also executes the process

March 29, 2006

# Key Findings for the Current State

- We are measuring, not just inspecting
  - Process control, conformance to tolerance, product design and development, and calibration
- Lack of digital form of measuring system capabilities – performance, uncertainty, configuration
- Tolerance definitions – incomplete, inaccurate, wrong, ambiguous with no change capability or associativity back into CAD product design.
- No standard digital form of manufacturing and inspection rules/knowledge – now just a lot of cut and paste
- Lack of DMIS compatibility and (interactive and/or static) conformance classes.

# Vision

- Product definition data from any CAD/CAM system run on any CMM/Measuring Equipment appropriate to requirements
- Represent results back to CAD
- Accessible and extendible knowledge base – not invisible/lost in black box
- Auto process/program generation
- Standard graphical representation of deviation
- Retain representation of raw data throughout manufacturing life cycle and lossless compression
- Keep all data all the time, forever
- Results feedback into process planning at different timescales to optimize measurements
- Link Everything back into enterprise content management (beyond PDM)
- Cost predictive tool – design for manufacturability, tolerance for inspectability (ABC, history based)

# Issues

- Lack of CAD vendor interest
- Parts that don't have CAD models
- Culture change necessary to align design/manufacturing/measure
- How comprehensive should the scope of our efforts be?
- Addressing needs of small manufacturers
- Education and lack of knowledge
- Understandability/unambiguous of standards and units

# “To Be” Activity Diagram

Measure